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ABSTRACT

This report describes the experience of the Department of Secondary Education in acquiring and applying three microcomputers: MSEA, (Micro-Computer System for Educational Applications), North Star HORIZON, and VECTOR. MSEA was designed as a central facility that would be capable of providing all types of educational computing research and service, and would include all important computer peripherals. The North Star HORIZON microcomputer was chosen for its portability and power, to be used in workshops and other outreach in the schools and community colleges. The VECTOR microcomputer together with special software was designed and installed for the Office of the Graduate Dean in the College. Each of these microcomputers can be used for instructional or administrative applications and for research, teaching, or service to students and staff. The implementation of these systems has contributed not only to development of staff and computer uses in the College of Education, but to several research and development projects in the department. (JEG)

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The Illinois Series

on

Educational Application of Computers

ACQUISITION AND APPLICATIONS OF THREE MICROCOMPUTERS BY THE DEPARTMENT OF SECONDARY EDUCATION

Jeff Case, J. Richard Dennis, Bruce Hicks and Viktors Muiznieks

January 1979

Department of Secondary Education
University of Illinois

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ISEAC Number 29

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1. Introduction

The Department of Secondary Education, University of Illinois has been developing the uses of computers in teaching and research and for outreach into the schools for more than a decade. Our Illinois Series on Educational Application of Computers (ISEAC) has distributed our studies widely, in and outside of the state. Microcomputers have been our most recent area of concentration. This report reviews our microcomputer activities, which serve not only the Department but the College of Education as well.

Our largest (and first) microcomputer system, MSEA (Micro-Computer System for Educational Applications), was designed as our central facility that would be capable of providing all types of educational computing research and service and would include all important computer peripherials. The North Star HORIZON microcomputer was chosen for its portability and power, in workshops and other outreach in the schools and community colleges. A VECTOR microcomputer, together with special software that we developed, was designed and installed for the Office of the Graduate Dean in the College. Each of these microcomputers can be used for instructional or administrative applications and for research, teaching or service to students and staff. The computers and our consulting work have supported the development of staff and of computer uses in our department and also in the departments of elementary education and of educational psychology.

The implementation of these systems has been central to several research and development activities in the Department. Early in 1977, members of the Department initiated a new undergraduate teacher education minor in instructional application of computers. This program attempts to prepare preservice teachers of any conventional subject to use the computer as a tool in the teaching of

that subject (Dennis, 1978). Research related to the design of this program and preparation for dissemination of a variety of program resources has been financed by a grant from EXXON Education Foundation. As a part of the undergraduate minor, students have occasion to go to nearly schools to do short duration computer activities. Micro-computers are a natural for such activity because of their mobility and freedom from communication connections to a central point.

This work also has led to an NSF grant to do inservice teacher education in a variety of settings not now possessing computer equipment. Microcomputers particularly are helpful for workshop style programs and for eliminating major portions of the arrangements that must be made to conduct extramural computer courses for a variety of audiences.

A second major area of investigation precipitated by the introduction of microcomputers has been the design, documentation and effects of computerized instructional functions. One of the earliest of these was an extensive R&D project on data manipulation and retrieval systems and their potential uses in instruction. This activity is reported in detail in ISEAC Nos. 9 and 13. A more recent project centered on the effects of computerized test grading and analysis on teacher testing behavior. Among the results of this project is the finding that when a computer system facilitates testing beyond the level of reporting test data, but additionally provides extensive assistance in interpreting that data, that teachers tend to test more frequently and to utilize such information as a basis for improving tests for future use (Muiznieks, 1978).

The several sections of this report summarize the various phases of use, design and acquisition of the three microcomputers.

2. Usage

MSEA

This computer has been operating in its present form for more than a year. As a sample of current usage we analyzed data for a period of three months with the results shown in Table 1.

Table 1

MSEA Usage

(March, April, May 1978)

Type of Use	Average hours/wk.
by students	20
by faculty	5
in demonstrations	2
maintenance & improvements	2
by Ed. Psych. Department	4
other	7
	40 hours/week total

MSEA was also used in Illinois High School District 214 in August 1976 and March 1977 for workshops. The HORIZON is better suited to this purpose because it is more compact and rugged.

VECTOR

This computer, delivered in April, 1978, was used an average of 20 hours per week (varying from 2 to 60 hours per week, May 15 to July 15, 1978). The use included training, data entry and verification, data retrieval, programming and use of existing programs.

HORIZON

No data because use of this computer started mid-summer, 1978.

3. Components, Compatibility and Communication

All three systems MSEA, Vector, and Horizon are built around the S-100 bus. Therefore, almost all components are "interchangeable" among systems, i.e., by moving the component and its corresponding interface card(s), the component can be used with any of the three mainframes. This adds a great deal of flexibility to system configuration, eases troubleshooting procedures, and allows for the sharing of expensive peripherals. Communication also is possible between systems (as discussed later).

Table of Components

(an x indicates the component is normally found in that system)

	MSEA	VECTOR	HORIZON
8080 CPU	X		
Z-80 CPU		X	X
PROM/RAM bootup		X	
terminal	X (DECWRITER) & Infoton	X (SOROC)	X (Infoton)
k'yb'd & monitor	X		
printer	X	X (has interface cable)	
papertape reader	X		
cassette tape recorder	X		
card reader (punched & mark sense)	X		
joysticks	X(2)		
color TV	X		
floppy disks	X	X	
micro floppy disks			X
RAM memory	57¼ K	49K	32K
ROM memory	½K used, 2K max	½K used, 2K max	
digital analog board	X		
vector interrupts	X		
clock	X		X
front panel programming	X		

The PROM/RAM board of the Vector cannot be moved into MSEA (unless front panel logic is disabled on the board). No (slow) Z16 K memory board can go into the Horizon system (unless the Z-80 processor is slowed down, which may require a different crystal). Other boards can be moved from one system to another (without modification).

Communication is achieved between MSEA and the Vector by means of the floppy diskettes, which are completely interchangeable between the two systems (since both use ICOM floppy disk drives). Also the FDOS III operating system is used on both systems.

Communication from MSEA or the Vector system to the Horizon is harder to achieve since the disk drives are different (and the diskette sizes are different). Program files may be stored on cassette tape (using the appropriate utility program), the cassette interface board moved to the other system, the program file loaded into the systems' memory, and a utility program run to load the programs/files from memory onto the system's floppy disks. Further, since the operating systems and BASICs are different, changes to programs and files probably will be required. (The changes can be made using the editors supplied in the various systems.)

Communication with a CYBER-175 computer (over the phone lines) is possible with MSEA (with information coming from the CYBER to MSEA only, at this point in time). Communication from MSEA to the CYBER-175 is planned, as is two way communication between MSEA and the PLATO system.

4. System Costs and Construction

MSEA

Cost (see ISEAC No. 20) - about $15,000 total

Construction

We estimate 1000-1500 man-hours for construction and maintenance so far and for hardware, software and peripheral interfacing.

Vector

Cost (all assembled, "tested", and warranted for 90 days) Vector Graphic mainframe, powersupply, cabinet, 12-slot motherboard; Z-80 CPU board; 16K RAM memory; ICOM dual floppy disk drives with cabinet, power supply, interface & controller; vector PROM/RAM bootup board; SOROC IQ-120 CRT terminal; 3P+S interface board.

purchased on bid - total cost	= $5000
added 16K RAM memory board (assembled)	= $ 408
3 edge connectors & guides	= $ 15
Hardware Total	= $5423

Also, some extra cost for interface cables, blown circuits and replaced or added parts and tools would increase cost $100-150 if these are not available around the shop.

Construction

We added interfaces to MSEA's line printer and to the SOROC terminal. This took two weeks x two men x ½ day to fix "tested" system and to add interfaces to terminal and printer. (12 days x 2 men x 6 hours per day) = 144 hours! It would take much longer without a scope and an already existing system like MSEA to use in trouble-shooting.

HORIZON

Cost (all assembled, tested, with warranty) Horizon mainframe, power supply, 12-slot motherboard; 16K RAM memory; Z-80 CPU board; dual Shugart microfloppy drives, interface and controller; serial I/O interface:

$2230 ($2349 less 5% educational discount)	
added 16K RAM memory	= $ 479
added Infoton CRT terminal	= $1200 (from MSEA)
added 9 edge connectors and guide	= $ 45
Hardware Total	= $4954

plus tools and interface to CRT terminal which already existed.

Construction 21 hours making sure that terminal interfaced properly and programming I/O routines to interface with operating systems.

5. SYSTEM DELIVERY AND GETTING INTO OPERATION

It has been our experience that the length of time after ordering and receiving and before actually operating a microcomputer system is heavily dependent on the vendor from whom the equipment is ordered and the form in which the system comes (assembled vs. kit). We have found that ordering from local (in town, easily accessible) vendors has produced faster delivery time

and higher quality workmanship in construction. Also, it is easier to get service from local vendors when the equipment needs repair.

The original MSEA system first was ordered during June 1976 in kit form. The mainframe and memory arrived during July 1976, construction immediately was begun, and the mainframe was operating in August 1976 (with 8K memory and I/O only by front panel switches). By October 1976 MSEA was capable of supporting an ASR-35 teletype and a paper tape operating system, and by February 1977 MSEA was operating with a cassette tape operating system. Finally, in July 1977, MSEA was working with a floppy disk operating system and all memory.

During the construction of MSEA we experienced several problems (from poor and erroneous vendor documentation as well as hardware failures). We relied heavily on local storerooms for spare parts, and local talent for advice and assistance. We would not recommend a kit-building route for a novice who does not have access to a good supply of spare parts (and computer experts). A good oscilloscope and an ability to understand schematic diagrams also are essential prerequisites for kit-building.

Both the Vector and the Horizon systems were ordered assembled. The Vector system took the longest to acquire. Bids were sent out in November 1977 and a purchase order was released in December 1977. The system was "delivered" in five shipments (covering a five week time span) starting in March 1978. All of the component parts necessary to operate the system finally arrived in April 1978. (The Vector system was purchased from an out-of-town vendor who had sent in the lowest bid.) The system had numerous problems when put together (parts blew, components failed to work, ROM addresses

conflicts, etc.). It took two experienced computer professionals two weeks of intensive troubleshooting (using a high quality oscilloscope and the front panel and ports from the MSEA system) to finally get the Vector system operating in May 1977. We were very unsatisfied with the delivery, quality of work, and troubleshooting assistance provided by the Vendor supplying the Vector system (Precision Medic, Arlington Heights, Illinois).

The Horizon system was ordered from a local vendor in May 1978, and arrived in July 1978. The hardware worked as soon as it was plugged in, although the BASIC software had a bug that took a call to the North Star company to fix. A defect in a memory board soon became evident however, and this was not replaced by the vendor until September, 1979.

6. References and Documentation

Microcomputer Systems

MSEA - ISEAC No. 20 especially relevant

- off-line documentation manuals written by Muiznieks
- vendor documentation on all hardware/software.

Also ISEAC Nos. 1, 3, 15, 16, 25

VECTOR - off-line documentation by Muiznieks

- ISEAC Nos. 10, 11 and 13
- vendor documentation

HORIZON - only vendor documentation so far.

Non-ISEAC References

Dennis, J. R. "Undergraduate Programs to Increase Instructional Computing in Schools" Proceedings of 9th Conference on Computers in the Undergraduate Curriculum, June, 1978.

Muiznieks, V. J. "Meaningful Test-Result Reporting" Proceedings of 16th Annual AEDS Convention, May, 1978.

Muiznieks, V. J. "The Effects of Computerized Test-Result Reporting on Teachers' Use of Test Results." Unpublished doctoral thesis, College of Education, University of Illinois, July, 1978.

ISEAC References (See pages 11 and 12)

January, 1979

Department of Secondary Education
College of Education
University of Illinois (Urbana)

PUBLICATIONS

The Illinois Series on Educational Applications of Computers (ISEAC)

Publication Date	Number	Report
3/75	1*	Applications of Computers in the Whole School-Five Examples. Goddard and Hicks
2/75	2	A Study of Computer Simulations for Environmental Science Education. Dirks, Singletary and Hicks
8/75	3*	Students: Where the Action Is! Hicks, Goddard and Keasler
3/76	4	The Use of Computers for Instructional Purposes - A Preliminary Survey of Selected Secondary Schools in Illinois. Berryman, Doring and O'Rourke
4/76	5	Maxicalculators for the Whole School. Doring and Hicks
4/76	6	A Detailed Comparison of Maxicalculators. Doring and Hicks
8/76	7	Elders, Students and Computers: A New Team. Hicks and Jaycox
9/76	8	Elders, Students and Computers: Background Information. Jaycox and Hicks
5/76	9	INFO - A Data Manipulation and Retrieval System in BASIC. Pelczarski
9/76	10	Management of an Educational Computer System . Pelczarski
11/76	11	CAISP - Computer-Assisted Individualized Study Program. Pelczarski
12/76	12	Documentation of CAISP. Pelczarski
11/76	13	INFOSH - A BASIC Program for File Search. Muiznieks
10/76	14	Low-Budget Computer Programming in Your School. Dennis and Thomson.
3/78	15	Notes on Recent Educational Applications of Computers. Hicks
3/78	16	Microcomputer Painting: A New Medium for Art Education . Hicks and Zibit
---	17	Spelling Judgers - A Must for Many Interactive Instructional Programs. Dennis and Brockus
2/77	18	Simulation Gaming in the Teacher Education Curriculum. Dennis and Gaede
11/76	19	Computer Classification of Triangles and Quadrilaterals - A Challenging Application. Dennis
2/77	20	MSEA - A Microcomputer System for Educational Applications. Hicks
2/77	21	Procurement Policies for CAI Systems. Muiznieks
6/77	22	Computer Literacy. Rosen and Hicks

*Republished, in modified form, as "Computers for the Whole School", (Hicks, Ed.), People's Computer Co. (Menlo Park, 1977).

11/77	23	Documentation of Courseware Libraries. Dennis and Rhodes
6/77	24	Computer Activities in Illinois Secondary Schools. Dennis, Dillhunt and Muiznieks
10/78	25	A Multi-Purpose Educational Medium - MC Painting. Zibit and Hicks
11/78	26	A General Introduction to Microcomputers. Muiznieks
12/78	27	MSEA - The Department's Microcomputer. Muiznieks
---	28	A Study of Computer Uses for Elders in Vancouver. Hicks
1/79	29	Acquisition and Applications of Three Microcomputers by the Department of Secondary Education. Case, Dennis, Hicks, Muiznieks
2/79	30	Instructions for Microcomputer Painting. Kosan and Hicks.
2/79	31	Documentation for MSEA Microcomputer Painting Programs. Hicks and Zibit
12/76	Unnumbered	How to Write a CAISP Unit. Pelczarski

Reference

1R. Computer Outreach. Hicks. "Computers and Society," 7, No. 3; 10-14 (Fall, 1976) and No. 4; 1-2 (Winter, 1977).

Resource Materials for Teacher Education

During the 1978-79 academic year we shall be publishing a special set of ISEAC reports in addition to our regular monographs. This special set will contain resource materials for a variety of post-secondary teacher education programs in educational application of computers. There will be approximately 15 titles in the complete set. All documents will be available by late summer 1979.

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